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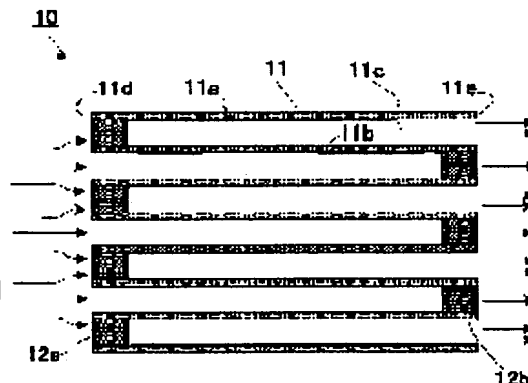
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(54) CERAMIC HONEYCOMB FILTER

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a porous ceramic honeycomb filter having small pressure loss and preventing cracks or erosion due to thermal shocks when the filter is to be regenerated.

SOLUTION: The filter aims to remove particles included in exhaust gas and has a ceramic honeycomb structure in which desired positions of the edges are sealed with a sealing material. The porosity of the walls in the ceramic honeycomb structure is 50 to 80%, while the porosity of the sealing material is larger than the porosity of the walls, and the sealing depth is 3 to 15 mm. The sealing material has pores and at least a part of the cross-sectional forms of the pores in the sealing material in any cross section is almost circular.



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CLAIMS

[Claim(s)]

[Claim 1] The ceramic honeycomb filter characterized by being the filter from which the particle contained in exhaust gas is removed, and the porosity of 50 - 80% and said eye sealing agent having the porosity of the septum of said ceramic honeycomb structure object larger than the porosity of a septum in the ceramic honeycomb filter of the gestalt which carried out eye closure of the request part of the both ends of a ceramic honeycomb structure object with the eye sealing agent, and eye closure thickness being 3-15mm.

[Claim 2] The ceramic honeycomb filter which it is the filter from which the particle contained in exhaust gas is removed, and pore exists in said eye sealing agent in the ceramic honeycomb filter of the gestalt which carried out eye closure of the request part of the both ends of a ceramic honeycomb structure object with the eye sealing agent, and is characterized by a part of cross-section configuration [at least] of the pore in the arbitration cross section of an eye sealing agent being an approximate circle configuration.

[Claim 3] The ceramic honeycomb filter according to claim 1 to 2 with which septum wall thickness of said honeycomb structure object is characterized by the pitch of 0.1-0.5mm and a septum being 1-3mm.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the ceramic honeycomb filter which carries out uptake of the particle contained in the exhaust gas from a diesel power plant about the exhaust gas purge of an automobile.

[0002]

[Description of the Prior Art] In order to remove the particle which uses carbon as a principal component from the exhaust gas discharged from a diesel power plant from the maintenance side of a local environment or earth environment, eye closure of the both ends of a ceramic honeycomb structure object is carried out by turns, and the ceramic honeycomb filter (henceforth [a "ceramic honeycomb filter" is omitted and] a "honeycomb filter") which made two or more passage of a honeycomb structure object blockade by turns at both ends has come to be used.

[0003] Drawing 3 is the perspective view of a honeycomb filter 50, and drawing 4 is the type section Fig. of the honeycomb filter 50 of drawing 3 . As shown in drawing 3 and drawing 4 , usually a honeycomb filter 50 Approximately cylindrical or the porosity ceramic honeycomb structure object which has cel 51c of a large number surrounded by septum 51b by the inner circumference side of peripheral-wall 51a and this peripheral-wall 51a by the shape of an abbreviation ellipse (Hereafter, a "porosity ceramic honeycomb structure object" is omitted and it is called a "honeycomb structure object") Eye closure of the both-ends side of 51d and outflow side 51e is carried out with the eye sealing agents 52a and 52b by turns the inflow side of passage 51c of 51.

[0004] Exhaust gas purification with a honeycomb filter 50 is performed as follows. Since exhaust gas flows by drawing 4 from passage 51c which is carrying out opening by 51d the inflow side of a honeycomb filter 50 (50a shows) and the eye closure of the outlet side is carried out, after exhaust gas passes the pore (not shown) formed in septum 51b, without the ability flowing out as it is, it is discharged from outflow side of contiguity cel 51e (50b shows). And in case the particle contained in exhaust gas passes to the passage which adjoins from the pore which continues within septum 51b, it is filtered, and uptake is carried out. Since the blinding of a filter will generate the particle caught by cell wall 51b if it becomes more than a constant rate, it is made to burn by the burner or the electric heater, and playback of a filter is performed. Although especially the thing for which the pressure loss of a filter is pressed down low is important in order not to reduce an engine performance about the property of the honeycomb filter of the above structures, the collection efficiency of a particle, the breakage-proof nature at the time of filter playback, and erosion-proof nature are also important. Although reduction becomes possible by enlarging the porosity and pore dimension of a septum about the pressure loss of a filter in these, and making resistance to exhaust gas small, on the other hand, enlarging porosity and a pore dimension leads to the fall of a septum on the strength, and it has the problem that the breakage-proof nature of a filter falls. Moreover, although the eye sealing agent arranged in the both-ends side of a honeycomb filter was indispensable in order to make it exhaust gas pass the inside of a septum as shown in drawing 4 , the problem of having raised the pressure loss of a honeycomb filter by existence of this eye sealing agent, or reducing breakage-proof nature by a thermal shock etc. might be generated. Since it was such, it was substantially difficult to reconcile the pressure loss which is the essential property of a honeycomb filter, and breakage-proof nature. Then, in order to solve the above-mentioned trouble, the technique of adding amelioration paying attention to the porosity and dimension of an eye sealing agent of a honeycomb filter is indicated as follows.

[0005] It is the honeycomb filter which carried out the chain of the pore of the eye sealing agent by the side of an exhaust gas outflow to the patent reference 1 in three dimension, and the exhaust gas filter which made

the porosity of the eye sealing agent by the side of an exhaust gas outflow 110 - 140% of the porosity of a honeycomb structure object is indicated. Since according to this reference particle 50c deposited on right above [of the eye sealing agent by the side of an exhaust gas outflow] exfoliates good when back wash air is passed from an exhaust gas outflow side, while being able to prevent the blinding of a cell wall, it is supposed that the rise of the pressure loss of a honeycomb filter can be prevented. Furthermore, although the eye sealing agent by the side of an exhaust gas outflow circulates a gas, since most particles in exhaust gas do not make it pass, they suppose that the collection efficiency of a particle will not get worse.

[0006] On the other hand, in the patent reference 2, the eye closure thickness of the eye sealing agent of the both ends of a honeycomb filter is not uniform, and the emission-gas-purification filter which made the boundary of an eye sealing agent and a septum the ununiformity so that it might not continue by the straight line or the fixed pattern is indicated. according to this reference, since the boundary of an eye sealing agent and a septum is made into the ununiformity so that it may not continue by the straight line or the fixed pattern, the part which the part and heat of combustion which carry out stress concentration by the thermal shock concentrate will not be continued, stress and heat of combustion are distributed, and it is supposed that generating and the erosion of a crack by the thermal shock can be prevented.

[0007]

[Patent reference 1] JP,7-332064,A [the patent reference 2] The patent No. 3012167 official report [0008] [Problem(s) to be Solved by the Invention] However, the honeycomb filter of a publication in the patent reference 1 The porosity of a honeycomb structure object is 45% as indicated by the example. Furthermore, the porosity of the eye sealing agent by the side of an exhaust gas outflow is 110 - 140% of porosity (when the porosity of a septum is 45%) of a honeycomb structure object. It is 49.5 - 63% extent of porosity of an eye sealing agent. In the example Although 40 - 65% of porosity of an eye sealing agent is indicated and the effectiveness that the particle deposited on right above [of the eye sealing agent by the side of the exhaust gas outflow by back wash air] exfoliates is accepted Since the porosity of the eye sealing agent by the side of 45% and an exhaust gas outflow had the porosity of the septum of a honeycomb structure object as small as 40 - 65%, the ventilation resistance of the exhaust gas in a septum or an exhaust gas outflow side eye sealing agent was large, and there was a problem that the pressure loss of the honeycomb filter itself was large. Furthermore, the eye sealing agent by the side of an exhaust gas inflow be formed with the same ingredient as a honeycomb structure object, and since the porosity of an eye sealing agent and a septum be comparable and that exhaust gas pass be able to make pore in the exhaust gas inflow side eye closure section with thick thickness almost compared with a septum, there be also a problem that the pressure loss in a honeycomb filter inlet port became large, and the pressure loss as the whole honeycomb filter became large. moreover, when 50 - 80% of thing of high porosity is used for the ingredient which constitutes a septum in order to reduce the pressure loss in a septum If the porosity of the exhaust gas outflow side eye closure section is made into 110 - 140% of the porosity of a honeycomb structure object The porosity of an exhaust gas outflow side eye sealing agent became 55 - 112%, an eye sealing agent which exceeds 100% of porosity could not exist, it became difficult substantially to carry out uptake of the particle, and there was also a problem of it becoming impossible to demonstrate the function as a honeycomb filter. That is, since the porosity of the eye sealing agent by the side of that the porosity of a septum is small and an exhaust gas inflow was comparable as the septum, there was a trouble that pressure loss was large in an exhaust gas filter given in the patent reference 1. Moreover, the indication about the porosity of the eye closure section by the side of an exhaust gas inflow and an exhaust gas outflow suitable for the septum which has the high porosity of 50 - 80% of porosity, pore volume distribution, a pore gestalt, etc. is not carried out at all.

[0009] Moreover, like an exhaust gas purification filter given in the patent reference 2, if the eye closure thickness of the eye sealing agent of the both ends of a honeycomb filter is not uniform, and it is an ununiformity so that the boundary of an eye sealing agent and a septum may not be continued by the straight line or the fixed pattern In the passage which has an eye sealing agent with large eye closure thickness, since the surface area of the septum which mainly has a filtering function became small substantially, there was a case where the problem that the filter surface area of the honeycomb filter itself becomes small, and pressure loss becomes large as a result arose. On the other hand, in the part where eye closure thickness is small, since the plane-of-composition product between an eye sealing agent and a septum was small, both junction force was small, the crack occurred in the interface of an eye sealing agent and a septum, or there was a case where an eye sealing agent and a septum exfoliated by a pressure, a thermal shock, etc. by exhaust gas. Furthermore, if eye closure thickness was made into an ununiformity, since filter surface area for every honeycomb filter product was not able to become fixed and fluctuation would arise in the pressure loss for every product of a honeycomb filter as a result, there was a case where the problem that the manufacture

yield of a honeycomb filter worsens arose.

[0010] This invention was made in view of the above-mentioned technical problem, and its pressure loss is small and is to obtain the honeycomb filter which can prevent generating of the crack by the thermal shock at the time of filter playback.

[0011]

[Means for Solving the Problem] In order to reduce pressure loss, without reducing the breakage-proof nature of a honeycomb filter as a result of performing various kinds of examination about the septum and eye sealing agent of a honeycomb filter, this invention persons were making into the suitable range the porosity and the eye closure thickness of an eye sealing agent which are combined with a high porosity septum about the eye sealing agent formed in honeycomb filter both ends, acquired knowledge that the above-mentioned technical problem is solvable, and hit on an idea to this invention. Furthermore, without spoiling the breakage-proof nature of a honeycomb filter also by making into a suitable gestalt the pore gestalt of the eye sealing agent formed in the both ends of a honeycomb filter, it found out that pressure loss could be reduced and hit on an idea to this invention.

[0012] That is, the ceramic honeycomb filter of this invention is a filter from which the particle contained in exhaust gas is removed, and in the ceramic honeycomb filter of the gestalt which carried out eye closure of the request part of the both ends of a ceramic honeycomb structure object with the eye sealing agent, the porosity of 50 - 80% and said eye sealing agent has the porosity of the septum of said honeycomb structure object larger than the porosity of a septum, and it is characterized by eye closure thickness being 3-15mm. moreover , the ceramic honeycomb filter in connection with another invention of this invention be a filter from which the particle contain in an exhaust gas be remove , and in the ceramic honeycomb filter of the gestalt which carried out eye closure of the request part of the both ends of a ceramic honeycomb structure object with the eye sealing agent , pore exist in said eye sealing agent , and it be characterize by a part of cross section configuration [at least] of the pore in the arbitration cross section of an eye sealing agent be an approximate circle configuration . Furthermore, in the ceramic honeycomb filter of this invention, it is desirable that the septum wall thickness of said honeycomb structure object is [the pitch of 0.1-0.5mm and a septum] 1-3mm.

[0013]

[Function] Next, it explains per [in this invention] operation effectiveness. The porosity of the septum of a ceramic honeycomb structure object the ceramic honeycomb filter of this invention 50 - 80%, The porosity of the eye sealing agent formed in the both ends of a honeycomb filter is larger than the porosity of a septum. Since eye closure thickness is formed by within the limits which is 3-15mm, the exhaust gas which flowed into the passage which carried out opening to the inflow side of a honeycomb filter passes through the inside of the septum which has the high porosity of 50 - 80%. Were formed in the both ends by the side of the exhaust gas inflow of a honeycomb filter, and an outflow with being discharged through the adjoining passage. It has porosity higher than a septum, and since the eye closure section formed in the range whose thickness is 3-15mm at homogeneity can also be passed now, the pressure loss as the whole honeycomb filter can be reduced. moreover, from enlarging the porosity of the eye sealing agent formed in honeycomb filter both ends compared with the porosity of a septum Since the heat capacity of the eye closure section becomes small and the quick warming of an eye sealing agent becomes good compared with the eye closure section formed with the same ingredient as the conventional septum, Even if the thermal shock at the time of filter playback is added, the stress generated in an eye sealing agent, an eye sealing agent, and a septum interface can be pressed down small, and it becomes possible to prevent the crack initiation to a septum, the eye closure section, or a both interface. Furthermore, since it is formed in homogeneity so that eye closure thickness may become the range which is 3-15mm, the septum surface area of the passage where the eye closure section is arranged is secured, the junction force between the eye closure section and a septum is enough secured with low voltage force loss being acquired, and the problem that a crack occurs or the eye closure section drops out among both can be avoided. As stated above, according to the ceramic honeycomb filter of this invention, pressure loss can reconcile two opposite properties of excelling in breakage-proof nature low. Furthermore, the filter area for every honeycomb filter product becomes fixed, and it is effective in leading to stabilization of the pressure loss for every honeycomb filter product to try for eye sealing agent thickness to become the range which is 3-15mm.

[0014] Hereafter, the reason for numerical limitation of the ceramic honeycomb filter of above-mentioned this invention is described in a detail. The porosity of the septum of the honeycomb filter of this invention was made 50 - 80% because the pressure loss of a honeycomb filter became large, and since the ventilation resistance at the time of exhaust gas passing a septum as porosity is less than 50% becomes large, when

porosity exceeds 80%, it is for the collection efficiency of a particle to fall while reinforcement falls. The porosity of the septum of a honeycomb filter is 60 - 75% preferably from the reason for the above.

[0015] Since a part of exhaust gas can pass an eye sealing agent as the reason for making larger than the porosity of a septum the porosity of the eye sealing agent formed in the both ends of the honeycomb filter of this invention was mentioned above, Since the heat capacity of an eye sealing agent becomes small while becoming possible to reduce the pressure loss of a honeycomb filter, It is because the quick warming of an eye sealing agent becomes good, the stress generated in an eye sealing agent, an eye sealing agent, and a septum interface can be small pressed down even if a thermal shock is added, and it is hard coming to generate a crack. on the other hand -- the porosity of an eye sealing agent -- the porosity of a septum, and an EQC -- or If it becomes small, since the ventilation resistance of the exhaust gas in the eye sealing agent which has eye closure thickness thicker than septum thickness will become large, while a part of exhaust gas stops being able to pass an eye sealing agent easily and the pressure loss of a filter becomes large It is because the heat capacity of an eye sealing agent becomes large, so the stress generated in an eye sealing agent, an eye sealing agent, and a septum interface becomes large and it becomes easy to generate a crack, when a thermal shock is added. In addition, when the porosity of an eye sealing agent is larger than the porosity of a septum 5% or more, the effectiveness becomes large and is 10% or more still more preferably. Furthermore, as for the porosity of an eye sealing agent, considering as 70 - 90% is desirable. Since a part of exhaust gas stops being able to pass an eye sealing agent easily as the porosity of an eye sealing agent is less than 70%, pressure loss may go up. On the other hand, when the porosity of an eye sealing agent exceeds 90%, there is a possibility that the reinforcement of the eye sealing agent itself may be insufficient, and may be easy to generate a chip and a crack especially in a both-ends side at the time of canning or handling, uptake of the big particle in exhaust gas may not be carried out in the eye closure section, but it may be emitted into atmospheric air. Especially the range of the porosity of a desirable eye sealing agent is 75% - 85%. At this time, the porosity of the eye sealing agent by the side of an inflow and an outflow may be the same, or may differ.

[0016] Since the junction force of an eye sealing agent and a septum declined [eye closure thickness] by less than 3mm, when a mechanical shock and a thermal shock occurred, it carried out to 3-15mm in eye closure thickness because a crack may occur in a both interface and a septum and an eye sealing agent may exfoliate. In this case, it is because the problem that it is discharged by the outlet, without exhaust gas's passing through the part which exfoliated and carrying out uptake of the particle occurs. It is because filter area becomes small relatively, so pressure loss will become large on the other hand if eye closure thickness exceeds 15mm. Furthermore, more desirable eye closure thickness is 5-12mm. In addition, it can ask for eye closure thickness from the difference of a honeycomb filter overall length and the immersion depth by inserting a metal rod (a tip being slight chamfering at the diameter of about 0.8mm) from the open end of passage, and measuring the immersion depth of this rod.

[0017] Moreover, the ceramic honeycomb filter in connection with another invention of this invention Pore exists in an eye sealing agent, and since a part of cross-section configuration [at least] of the pore in the arbitration cross section of an eye sealing agent is an approximate circle configuration, with the permeability of exhaust gas being good Since the stress concentration in pore can be reduced and the reinforcement of the eye sealing agent itself can be secured, pressure loss can reconcile two opposite properties of excelling in breakage-proof nature low. A cross-section configuration needs to be [no pores] approximate circle configurations, and when the thing of an approximate circle configuration is contained in 1000-micrometer two or more pores, a part of [at least] pores, especially the pore with a big dimension with the large effect of the permeability and reinforcement on exhaust gas of the pore of an approximate circle configuration, for example, the cross section, are desirable. Here, in the arbitration cross section of an eye sealing agent, as for an approximate circle configuration, an aspect ratio says [a cross-section configuration] the thing of two or less pore. Furthermore, the aspect ratio of the cross section is more desirable among 1000-micrometer pores it is [pores] two or more in the percentage of two or less pore being 20% or more. An aspect ratio, it expresses with the ratio (a major axis/minor axis) of the major axis and minor axis of the considerable ellipse of the pore configuration of an arbitration cross section here. the time of forming an eye sealing agent, in order for a cross-section configuration to form the pore of an approximate circle configuration -- the inside of the eye sealing agent formation raw material of the shape of the shape of a slurry, and a paste -- abbreviation -- it can burn, an ostomy agent can be removed and a cross-section configuration can make the pore of an approximate circle configuration remain in an eye sealing agent by performing desiccation and baking, after adding the spherical ostomy agent and forming the eye closure section Furthermore, pore exists in the Motome sealing agent and coexistence of two opposite properties that the ceramic honeycomb filter a

part of whose cross-section configuration [at least] of the pore in the arbitration cross section of an eye sealing agent is an approximate circle configuration is further excellent in low voltage force loss at breakage-proof nature in the porosity of a septum having the porosity of 50 - 80% and said eye sealing agent larger than the porosity of a septum, and eye closure thickness being 3-15mm becomes easy.

[0018] In the ceramic honeycomb filter of this invention, the thing with desirable the septum thickness of a honeycomb structure object being [the pitch of 0.1-0.5mm and a septum] 1-3mm is based on the following reasons. Since septum thickness has set the porosity of a septum as 50 - 80% of high range in less than 0.1mm, the reinforcement of a honeycomb structure object falls, and it is not desirable. It is because the ventilation resistance of a septum to exhaust gas will become large however a septum may be high porosity if the cell wall thickness of a honeycomb structure object exceeds 0.5mm, so the pressure loss of a honeycomb filter becomes large on the other hand. More desirable septum thickness is 0.2-0.4mm. Moreover, it is because the opening dimension of the passage which carried out opening to the exhaust gas inflow side will become small if the pitch of a septum is set to less than 1mm, so the pressure loss in an inlet port becomes large and the pressure loss of a honeycomb filter becomes large. When the pitch of a septum exceeds 3mm, since geometric surface area (surface area of the septum per unit volume) becomes small, it is because the pressure loss of a honeycomb filter becomes large. The pitch of a more desirable septum is 1.2-2.0mm. As mentioned above, coexistence of the opposite property of excelling in low voltage force loss at breakage-proof nature becomes easier by making septum thickness and a septum pitch into the desirable range. Since it is used as a filter for this invention to mainly remove the particle in the exhaust gas of a diesel power plant as an ingredient which constitutes the septum and eye sealing agent of the above and a porosity ceramic honeycomb structure object, it is desirable to use the ingredient excellent in thermal resistance, and it is desirable to use the ceramic ingredient which considers at least one sort chosen from the group which consists of cordierite, an alumina, a mullite, silicon nitride, silicon carbide, and LAS as the main crystal. It is cheap, and the ceramic honeycomb filter which considers cordierite as the main crystal especially is excellent in thermal resistance and corrosion resistance, and the most desirable from being low-fee expansion.

[0019] Moreover, as for the above-mentioned Serra Mimic honeycomb filter, it is desirable that the end face of at least one of the two of an eye sealing agent considers as a concave configuration. It becomes possible to reduce pressure loss further, the real thickness of an eye sealing agent becoming it small that the end face of an eye sealing agent is a concave configuration, and maintaining breakage-proof nature. That is, it is because resistance to exhaust gas can be made small, the bonding strength between an eye sealing agent and a septum being maintained compared with the case where the end face of an eye sealing agent is flat, by becoming small compared with the septum side of passage about the passage core of eye sealing agent thickness. Although the effectiveness which makes pressure loss small will be accepted if the end face of an eye sealing agent means the entry side edge side of an inflow side eye sealing agent, a passage side edge side, the outlet side end face of an outflow side eye sealing agent, and a passage side edge side and the crevice is formed in at least one end face among these If the crevice is formed in two or more [of end faces of these], the effectiveness will become large further.

[0020] Next, an example of the approach of carrying out eye closure is explained to the ceramic honeycomb filter of this invention using drawing 2 . Drawing 2 is the type section Fig. showing the situation which has introduced the eye sealing agent on a honeycomb structure object. First, as shown in drawing 2 , after arranging the masking film 17-1 and 17-2 to the end face of a honeycomb structure object, punch station 17-1a and 17-2a are formed in it by turns to the passage of a honeycomb structure object. Moreover, the ceramic slurry 12 is adjusted and it contains in the container 18. In creation of this ceramic slurry, it is the purpose which obtains the porosity of a predetermined eye sealing agent, and a ceramic raw material with large particle diameter is used, or the approach of adding an ostomy agent etc. is chosen suitably. Especially when forming the pore which has the cross-section configuration of an approximate circle configuration in an eye sealing agent cross section into an eye sealing agent, a cross-section configuration can form the pore of an approximate circle configuration into an eye sealing agent a spherical ostomy agent, for example, the bead made of resin, and by adding the bead made of hollow resin more preferably, and carrying out combustion removal of this ostomy agent in a subsequent baking process. Subsequently, end-face 11e of the honeycomb structure object 11 is immersed in the ceramic slurry 12 created as mentioned above. The ceramic slurry 12 is introduced into the honeycomb structure object 11 through punch station punch station 17-1a of a masking film. Installation and a ceramic slurry dry the ceramic slurry 12 for the other end side of a honeycomb structure object on the honeycomb structure object 11 through punch station punch station 17-2a of a masking film after a ceramic slurry's drying similarly, and the masking film 17-1 and 17-2 are

removed. At this time, the eye closure thickness of 3-15mm is obtained by adjusting the dipping depth to the ceramic slurry of a honeycomb structure object. Then, calcinate an eye sealing agent, a septum and an eye sealing agent are made to unify, and the ceramic honeycomb filter shown in drawing 1 is obtained.

[0021] Moreover, not to mention being applicable to the filter of the mutual playback system which burns a particle by the burner or the electric heater, the ceramic honeycomb filter of this invention is applicable also to the ceramic honeycomb filter of the continuation playback type which carries out combustion removal of the particle continuously with an operation of the catalyst which the ceramic honeycomb structure object was made to support, if a particle becomes more than a constant rate as the conventional technique showed.

[0022] [Embodiment of the Invention] Hereafter, the gestalt of implementation of invention is explained to a detail. Powder, such as a kaolin, talc, a silica, hydroxylation aluminum, and an alumina, is adjusted. (Example 1) With a mass ratio SiO_2 : 47 - 53%, 2O_3 :32 - 38% of aluminum, MgO :12-16%, and CaO , The component mixed unescapable [Na_2O , K_2O , TiO_2 , Fe_2O_3 , PbO , P_2O_5 , etc.] to cordierite generation raw material powder which contains 2.5% or less on the whole 5-25 mass % addition of a shaping assistant and an ostomy agent was done, the water of the amount of conventions was poured in, still more sufficient mixing was performed, and the plastic matter in which extrusion molding is possible was adjusted to honeycomb structure. The cross section which carried out extrusion molding using the extrusion molding die of general structure, and was surrounded with the wall by the inner circumference side of a peripheral wall and this peripheral wall and by the shape of a square The various Plastic solids which adjust a metal mold dimension and the addition of an ostomy agent, and have honeycomb structure are produced, and baking after desiccation is performed so that various kinds of septum thickness and the porosity of a septum may be obtained. By diameter [of 150mm] x die length of 150mm The honeycomb structure object which has various kinds of septum thickness and various kinds of septum pitches, and has various porosity was produced. Next, although not illustrated, after sticking a masking film on the both-ends side of a honeycomb structure object with adhesives, it punched so that it might become a checker, then the eye closure was carried out to the honeycomb structure object. First, the ostomy agent was added if needed to cordierite-sized raw material powder, water, a shaping assistant, etc. were added, the nature of cordierite ceramic slurry 12 was created, and it contained in the slurry container 18. And as shown in drawing 2, end-face 11e of the honeycomb structure object 11 was immersed in the ceramic slurry 12, the eye closure depth of the eye sealing agent 12 was changed and introduced into the honeycomb structure object 11 through punch station 17-1a and 17-2a of the masking film 17-1 and 17-2, and the masking film 17-1 and 17-2 were removed after that. Subsequently, the eye sealing agent was calcinated carrying out temperature control using a batch type firing furnace (not shown), and the ceramic honeycomb filter 10 which various porosity ***** was obtained. Next, the septum thickness (mm) of the honeycomb structure object 11, the pitch (mm) of a septum, (%) and the porosity of septum 11b, (%) and the porosity of an eye sealing agent, eye closure thickness (mm), and its result are shown in Table 1 about the obtained honeycomb filter 10. In addition, it asked for measurement of eye closure thickness from the difference of a honeycomb filter overall length and the immersion depth by inserting a metal rod (a tip being slight chamfering at the diameter of about 0.8mm) from the open end of passage, and measuring the immersion depth of this rod. moreover, five into which measurement part divides diameters 21 and 22 of X-axis [of a honeycomb structure object], and Y-axis at equal intervals as shown in drawing 5 place x -- it carried out to five-place a total of 25 passage, and the average of the measured value of the 25th place closure thickness was made into eye closure thickness.

[0023] Moreover, as it was the following, evaluation of pressure loss and thermal shock resistance was performed. With the pressure loss testing device (not shown), the differential pressure of 11d and outflow side 11e was measured the inflow side after throwing in (b) carbon powder by 3 g/h for 2 hours. And 400 or less mmAqs were considered as success, it is (O) and what exceeds [the desirable case of less than 380 more mmAqs] good (O) and 400mmAq for A (O) and 380 - 400mmAq was evaluated as NG (x). Evaluation of thermal shock resistance held the filter for 30 minutes in the electric furnace heated by constant temperature, and quenched it to the room temperature after that, and the temperature gradient of whenever [stoving temperature / when a crack is discovered visually], and a room temperature was evaluated as heat-resistant impact temperature. Moreover, when a crack was not discovered, 25-degree-C temperature was raised and the same trial was performed, and it repeated until the crack occurred. It made the number of trials each into three pieces, and those averages considered 600 degrees C or more as success, it is (O) and the case where they were A (OO) and less than 600 degrees C about (O) and a still more desirable case 700 degrees C or more in a less than 700-degree C desirable case 650 degrees C or more was further evaluated as NG (x).

[0024] That both [whose] pressure loss and thermal shock resistance are success as a comprehensive judgment And (O), Pressure loss for both what (O) thermal shock resistance was (O) and was (OO) when it was the judgment of (O) Among those, (OO), At least one evaluates by (x) what is NG, and the septum thickness of a honeycomb filter, the porosity of a septum, the porosity of an eye sealing agent, the eye closure depth, and a pressure loss evaluation result and thermal shock resistance are collectively shown in Table 1.

[0025]

[Table 1]

試験NO		ハニカム構造体			目封止材		評価結果		総合判定
		隔壁厚さ (mm)	隔壁ピッチ (mm)	隔壁の気孔率 (%)	気孔率 (%)	厚さ (mm)	圧力 損失	耐熱 衝撃性	
試験NO.1	本発明例	0.15	1.46	50	55	3	○	○	○
試験NO.2		0.2	1.46	55	65	5	○	○	○
試験NO.3		0.22	1.52	60	69	10	○	○	○
試験NO.4		0.22	1.52	65	75	10	◎	○	○
試験NO.5		0.25	1.52	75	80	12	◎	○	○
試験NO.6		0.31	1.52	65	80	11	◎	○	○
試験NO.7		0.3	1.52	78	85	15	◎	○	○
試験NO.8	比較例	0.08	1.46	51	55	5	○	×	×
試験NO.9		0.12	1.46	45	22	2	×	×	×
試験NO.10		0.28	1.52	70	45	12	×	×	×
試験NO.11		0.25	1.52	85	90	15	◎	×	×
試験NO.12		0.6	1.52	51	55	5	×	○	×
試験NO.13		0.15	1.52	50	55	18	×	○	×

[0026] Septum thickness had [the porosity of 0.1-0.5mm and a cell wall] the porosity of 50 - 80%, and an eye sealing agent larger than the porosity of a septum, since eye closure thickness was 3-15mm, the honeycomb filter of trial NO.1-7 which are an example of this invention from Table 1 had good evaluation of pressure loss and thermal shock resistance, and the comprehensive judgment was (O). Since especially the examples 4-7 of invention had the porosity of an eye sealing agent in the more suitable range which is 70 - 90%, evaluation of pressure loss was (O). On the other hand, since eye closure thickness was less than 3mm, as for the honeycomb filter of trial NO.8 which are an example of a comparison, thermal shock resistance fell, and the comprehensive judgment was (x). The porosity of a septum was less than 50%, since the porosity of an eye sealing agent was smaller than the porosity of a cell wall, as for the honeycomb filter of trial NO.9 which are an example of a comparison, pressure loss became large, and the comprehensive judgment was (x). As for the honeycomb filter of trial NO.10 which are an example of a comparison, thermal shock resistance also fell with pressure loss becoming large since the porosity of an eye sealing agent is smaller than the porosity of a septum although the porosity of a septum is 50 - 80% of range, and the comprehensive judgment was (x). Since, as for the honeycomb filter of trial NO.11 which are an example of a comparison, the porosity of a septum was over 80%, thermal shock resistance fell and the comprehensive judgment was (x). Since the eye closure depth is over 15mm and, as for the honeycomb filter of trial NO.12 and trial NO.13 which is an example of a comparison, filter area became small, pressure loss became large and the comprehensive judgment was (x).

[0027] (Example 2) By the same approach as an example 1, it has bulkhead structure with a pitch 1.5mm [of diameter / of 150mm / x die length of 150mm, and a septum], and a septum 11b thickness of 0.3mm, and the porosity of an eye sealing agent produced [the porosity of a septum] the nature of cordierite ceramic honeycomb filter 10 whose eye closure thickness is 10mm 78% 65%. However, when creating the nature of cordierite ceramic slurry 12 at the time of forming the eye sealing agent of trial NO.14-17, it changed and added, water, a shaping assistant, etc. were added further, the addition was mixed, and the bead made of methyl METAKURU rate-acrylonitrile-copolymer resin which is a spherical ostomy agent at cordierite-ized raw material powder was obtained. Next, the gestalt of the pore in the arbitration cross section of an eye sealing agent was measured about the obtained honeycomb filter 10. After grinding in the cross section where measurement of the gestalt of the pore in the arbitration cross section of an eye sealing agent accompanied in the direction of passage of a honeycomb filter here, SEM observation was performed and the existence of the pore of an approximate circle configuration was visually checked from the SEM image. Furthermore, the aspect ratio of pore was measured by image analysis to the above-mentioned SEM image, and the aspect ratio computed the rate of two or less pore among the pores whose cross sections are two or more [1000-micrometer]. To the image data of a SEM image, measurement of the above-mentioned aspect ratio analyzed with commercial image-analysis software (image prop lath [by the media cybernetics company] VAJON 3.0), and was expressed with the ratio (a major axis/minor axis) of the major axis and

minor axis of the considerable ellipse of the pore configuration of an arbitration cross section. Moreover, evaluation of pressure loss and thermal shock resistance was performed by the same approach as an example 1 to the above-mentioned ceramic honeycomb filter.

[0028]

[Table 2]

	目封止材		評価結果		総合判定
	略円形状の細孔の有無	アスペクト比2以下の細孔の割合 (%)	圧力損失	耐熱衝撃性	
試験NO.14	有り	15	◎	◎	◎
試験NO.15	有り	12	◎	◎	◎
試験NO.18	有り	42	◎	◎◎	◎◎
試験NO.17	有り	65	◎	◎◎	◎◎
試験NO.18	無し	0	◎	○	○
試験NO.19	無し	0	◎	○	○

[0029] since the pore of an approximate circle configuration exists [a cross-section configuration], while the honeycomb filter of trials 14-NO 17 shows a low voltage force loss property in an eye sealing agent -- especially -- thermal shock resistance -- excelling -- **** -- evaluation of thermal shock resistance -- any -- (O) -- or (OO) and since it became -- a comprehensive judgment -- (O) -- it became [or / (OO)]. Especially evaluation of thermal shock resistance since it is the rate of two or less pore among the pores whose cross sections are two or more [1000-micrometer] and the aspect ratio of the honeycomb filter of trial 16 and NO 17 is 20% or more in the arbitration cross section of an eye sealing agent became (OO), and the comprehensive judgment was also (OO). on the other hand -- trial NO. -- since, as for the honeycomb filter of 18 and 19, the pore of an approximate circle configuration did not exist [a cross-section configuration] in the eye sealing agent, the judgment of thermal shock resistance became (O) and the comprehensive judgment became (O).

[0030] (Example 3) By the same approach as an example 1, it has bulkhead structure with a pitch 1.5mm [of diameter / of 150mm / x die length of 150mm, and a septum], and a septum 11b thickness of 0.3mm, and the porosity of an eye sealing agent produced [the porosity of a septum] the nature of cordierite ceramic honeycomb filter 10 whose eye closure thickness is 10mm 60% 65%. Here, when creating the nature of cordierite ceramic slurry 12 at the time of forming the eye sealing agent of trial NO.20-23, like the example 2, it changed and added, water, a shaping assistant, etc. were added further, the addition was mixed, and the bead made of methyl METAKURU rate-acrylonitrile-copolymer resin which is a spherical ostomy agent at cordierite-ized raw material powder was obtained. Next, the gestalt of the pore in the arbitration cross section of an eye sealing agent was measured like the example 2 about the obtained honeycomb filter 10. Moreover, evaluation of pressure loss and thermal shock resistance was performed by the same approach as an example 1 to the above-mentioned ceramic honeycomb filter.

[Table 3]

	目封止材		評価結果		総合判定
	略円形状の細孔の有無	アスペクト比2以下の細孔の割合 (%)	圧力損失	耐熱衝撃性	
試験NO.20	有り	15	○	○	○
試験NO.21	有り	12	○	○	○
試験NO.22	有り	42	○	◎	◎
試験NO.23	有り	65	○	◎	◎
試験NO.24	無し	0	○	×	×
試験NO.25	無し	0	○	×	×

Since the pore of an approximate circle configuration existed [the cross-section configuration], while the honeycomb filter of trials 20-NO 23 showed the low voltage force loss property in the eye sealing agent, it excelled especially in thermal shock resistance, and since, as for evaluation of thermal shock resistance, all became (O) or (O), the comprehensive judgment became (O) or (O). Especially evaluation of thermal shock resistance since it is the rate of two or less pore among the pores whose cross sections are two or more [1000-micrometer] and the aspect ratio of the honeycomb filter of trial 16 and NO 17 is 20% or more in the arbitration cross section of an eye sealing agent became (O), and the comprehensive judgment was also (O). on the other hand -- trial NO. -- since, as for the honeycomb filter of 24 and 25, the pore of an approximate circle configuration did not exist [a cross-section configuration] in the eye sealing agent, the judgment of thermal shock resistance became (x) and the comprehensive judgment became (x).

[0031]

[Effect of the Invention] Above, as explanation in a detail, the honeycomb filter of this invention has small pressure loss, and its thermal shock resistance is good, and it can prevent generating and the erosion of a crack by the thermal shock at the time of filter playback.

[Translation done.]

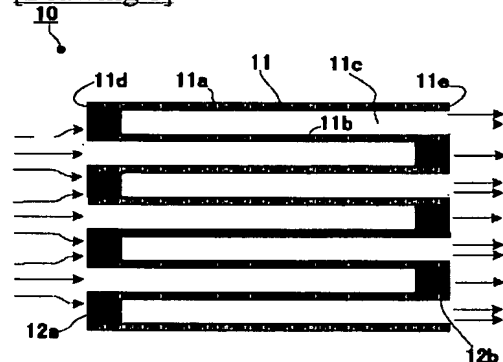
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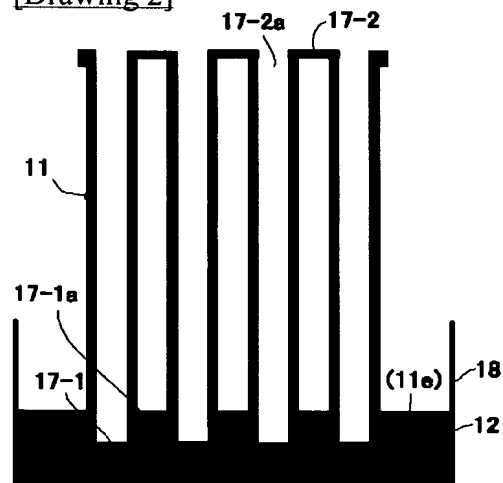
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

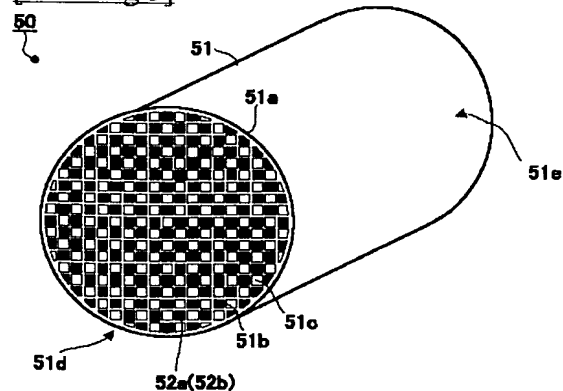
[Drawing 1]



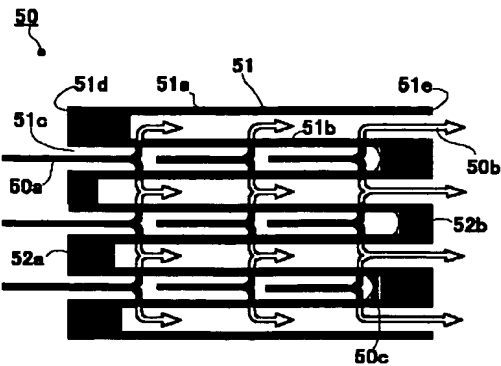
[Drawing 2]



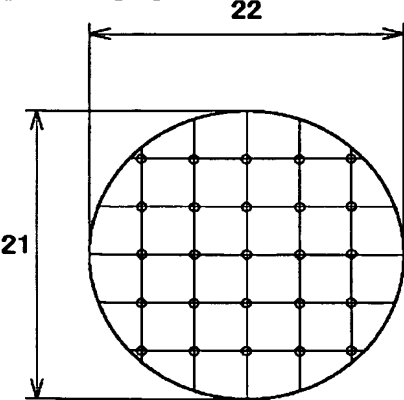
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]